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Analysis of nutritional quality of karahi paneer served at selected restaurants

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Abstract

Introduction: The food industry deals with highly sensitive products. This being the primary reason, maintaining quality standards and adhering to quality requirements are imperative for players in the food industry. It has been a proven fact that food served at restaurants is generally high in calories, fats and carbohydrates thereby leading to malnutrition and other health related disorders like overweight, obesity, heart diseases etc. on prolonged regular consumption. This food however generally lacks in certain essential nutrients like proteins, vitamins and minerals thus causing greater imbalance.

Objectives: The study was carried out with the following objectives:

- To calculate the proximate composition of karahi paneer served at selected restaurants
- To evaluate the nutritional adequacy of karahi paneer served thereto

Methodology: The karahi paneer samples were procured from private, public and fast food restaurants in a sterile ice box. Development of the standardized recipe and proximate composition analysis were performed to evaluate energy, carbohydrate, protein, fats, fibre, ash and moisture content. The proximate values were calculated in triplicate. The mean scores of the triplicates and standard deviation were calculated using SPSS 16.0 version.

Results and Conclusion: Karahi paneer served in most of the studied restaurants was found to be deficient in calories and proteins with reference to the standardized recipe. The karahi paneer of private restaurants (R1) was higher in carbohydrate (56 per cent) and fat (5 per cent) content whereas that served in public (R2) as well as fast food restaurants (R3) ranked higher in fat (4 per cent and 13 per cent respectively) and fibre (1 per cent and 6 per cent respectively) content only. However, a high downfall in fibre content (20 per cent) has been observed in case of private restaurants.

Keywords: Food quality, proximate composition, nutritional adequacy, restaurants

Introduction

The food industry deals with highly sensitive products. This being the primary reason, maintaining quality standards and adhering to quality requirements are imperative for players in the food industry. Total food quality management has been a hard challenge for all the restaurateurs since long. Consistent quality is critical for hospitality operations (Jones and Dent, 1994; Crandall *et al.*, 1996) [7, 3], in particular, restaurant food service operations (Bosselman, 1995). This is because customers of restaurants are more concerned with the consistency of the quality of food offered. However, providing a consistent level of food quality is a major challenging task (Walker, 2008).

It has been a proven fact that food served at restaurants is generally high in calories, fats and carbohydrates thereby leading to malnutrition and other health related disorders like overweight, obesity, heart diseases etc. on prolonged regular consumption. This food however generally lacks in certain essential nutrients like proteins, vitamins and minerals thus causing greater imbalance. Also routine customers are not very much aware of the nutritive value parameters which can help them make healthier choices. In addition to this, no nutritional information about the food being served is provided by the restaurants on their menu cards.

Keeping all these factors in mind, the present research entitled "Nutritional Quality Analysis of Karahi paneer served at Selected Restaurants" has studied the primary aspects of overall quality of the food served at private, public and fast food restaurants.

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Review of Literature

Known for menu items containing high amounts of fat, sugar, and salt, fast-food restaurants have contributed to increased risk of diet-related chronic diseases, like heart disease and diabetes. "Despite qualitative evidence that the fast-food industry is making improvements to the nutritional quality of at least some of their menu items, a quantitative evaluation of trends in the nutritional quality of fast food available in the marketplace was lacking," said lead investigator Mary Hearst, Ph.D., MPH, Associate Professor of Public Health at St. Catherine University in St. Paul, Minnesota. The overall nutritional quality score associated with the eight studied restaurants came out to be 48; quite below 55 of the average American diet in general, which the USDA considers far from optimal.

One in three Americans currently suffers from unhealthy weight, which can lead to conditions such as heart disease, diabetes, and depression. The causes of obesity are not limited to individual behaviors but include environmental factors, such as the availability of healthy food outlets. Understanding the influence of the food environment is especially relevant for college students living away from home, who consume most of their food commercially as they establish new eating habits. This study explored the quality, cost, and distribution of the food available at the University of Florida. Available food items and prices were obtained from Gator Dining Services for each dining location on campus in 2009, and the nutritional quality of the food was assessed using the Nutritional Quality Index (NQI). Food items were also coded based on location in order to determine if differences in nutritional quality existed that depend on the geographic area. Statistical analyses were conducted in order to determine if significant differences exist that are based on price and dining location. The average food item costs \$ 4.26 and contains 552 calories. The data suggest that foods high in fat and cholesterol are cheaper and more readily available than healthier foods, and the availability of healthy foods varies by location on campus.

Recent literature indicates that American society tends to offer foods that are higher in calories and fat at a cheaper cost and greater availability than fresh produce and other foods which are high in nutritional quality (Finkelstein, Ruhm, and Kosa, 2005) ^[4]. Residents living in areas with high concentrations of fast food restaurants are more likely to consume more calories, fat, saturated fat, and cholesterol (Lewis *et al.*, 2005) ^[9]. Moreover, studies have shown that providing nutrient-dense foods at the elementary, middle, and high school level increases students' daily intake of fruits and vegetables, improving their overall nutrition (Kubik, Lytle, Hannan, Perry, and Story, 2003) ^[8]. These findings are reinforced by Morland, Wing, and Diez Roux's research, which demonstrated that adults were more likely to consume diets high in fruits and vegetables and low in saturated fats when supermarkets containing these foods were in close proximity (2002).

Approximately one-third of main dishes at fast-food restaurant chains and half of main dishes at sit down restaurant chains exceeded the 2010 Dietary Guidelines for Americans recommended levels for sodium, fat, and saturated fat in 2014. Improvements in nutrient content were observed

for side dishes. At sit down restaurant chains, added side dishes contained over 50 per cent more calories, fat, saturated fat, and sodium, and were less likely to contain fruits/vegetables. Consumption of diet high in sugar, saturated fat, salt and calorie content in children can lead to early development of obesity, hypertension, dyslipidemia and impaired glucose tolerance. Fast foods have high level of fat and sugars that are not only unhealthy but addictive and that creates a vicious cycle making it hard for children to choose healthy food. High content of trans-fat in commercially available fast foods predispose children to risk of future heart diseases (Asgary S. *et al.*, 2009) ^[1].

Junk foods often contain colors that are inedible, carcinogenic and harmful to the body. Food coloring may result in hyperactivity and lapses of concentration in children. Poor nutritional habits can undermine these pre-requisites of learning, as well as decrease the strength that children need for making friends, interacting with family, participating in sports and games or simply feeling good about them.

Nutritional labeling refers to disclosure of nutritional content (calories, added sugar, total fat, trans-fat, saturated fat, sodium and protein content) in product labels. Nutritional value should be provided in menu, menu boards, food wrappers and containers in fast food restaurant. This might restrict the quantity and choice of food among children of educated parents. In a recent study conducted on parents of children aged 3-6 years, it was observed that parents who were offered the nutritional value menu card ordered food of lesser calorie (Tandon P.S. *et al.*, 2010) ^[11]. However in a study by Yamamota *et al.* (2005) ^[13], it was observed that provision of nutritional value did not modify the food ordering behavior among the enrolled adolescents. It has been often debated that labeling might result in financial loss to fast food industry, but it has been shown that restaurants which project lower fat menu have a better customer satisfaction (Fitzpatrick M.P. *et al.*, 1997) ^[5].

Methodology

Permission was sought from the restaurants and only 32 restaurants showed willingness to participate. Out of these, only 6 restaurants i.e. two private restaurants (R1), two public restaurants (R2) and two fast food restaurants (R3) were selected for nutritional quality analysis owing to the feasibility of sample collection. The karahi paneer samples were procured from private, public and fast food restaurants in a sterile ice box. The same were then dried in hot air oven to remove moisture and ground to fine powder. This powder was then used for proximate composition analysis to calculate the major nutrients energy, carbohydrate, protein, fats along with fibre. The standardized recipes were also formulated for each of the six recipes in consultation with the chefs of different restaurants and prepared by the researcher in hygienic settings. Proximate composition analysis was also performed to evaluate energy, carbohydrate, protein, fats, fibre, ash and moisture content in the laboratory. The proximate values were calculated in triplicate and thereafter the mean values of two restaurants of each type were calculated for usage in further discussions. The mean scores of the triplicates and standard deviation were calculated using SPSS 16.0 version.

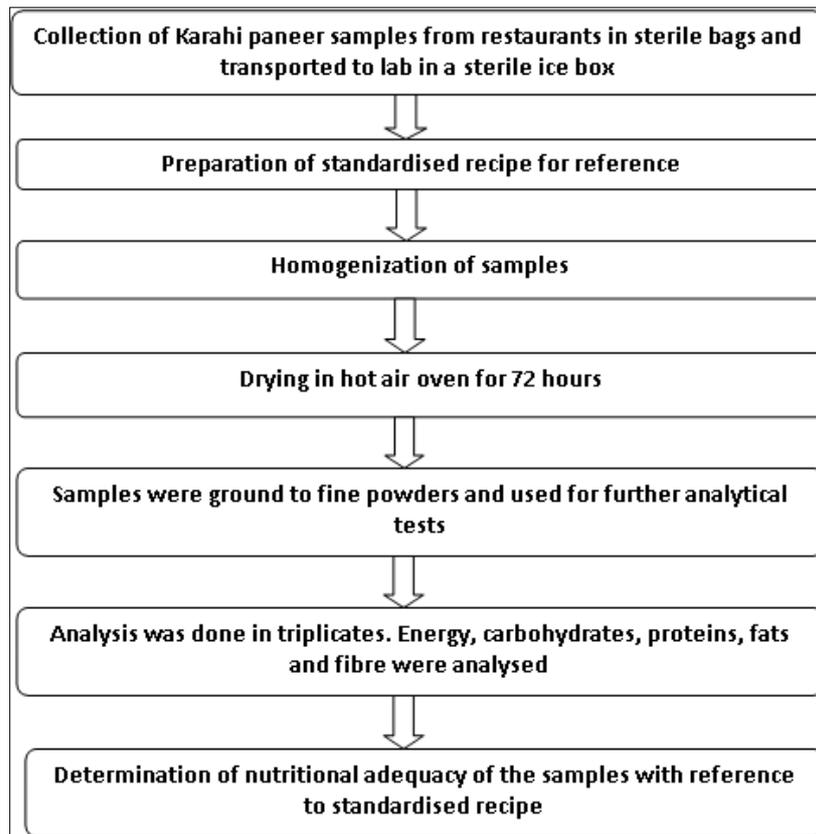


Fig 1: Methodology for Evaluating the Nutritional Adequacy of Karahi Paneer samples at a Glance

Fig. 1 represents the steps of methodology for evaluating the nutritional adequacy of karahi paneer samples at a glance. The details of the steps are presented and discussed in the subsequent sections.

Results and Discussion

A. Evaluation of Nutritional Quality of Karahi Paneer

The present data involves six studied restaurants i.e. two private restaurants (R1), two public restaurants (R2) and two fast food restaurants (R3). The mean of the values of both the restaurants of one type have been used in further discussions. To test whether the three types of restaurants differ over the major nutrients viz. carbohydrate, protein, fats along with fibre in karahi paneer being served at these establishments and the standardised recipe, one-way analysis of variance (ANOVA) was employed. The results of ANOVA for these four nutrients appear in Table 2. An evident variation was observed at all four nutrients amongst these establishments and also significant difference was found in standardized recipe with each organization studied. It may be noted that the degrees of freedom (d.f.) being 2 and 6, the tabulated F-value is 5.14 and 10.92 at 0.05 and 0.01 probability levels, respectively. In majority of the cases, the calculated F-value for the components was found to be highly significant at both the probability levels. It clearly indicated that all the six organizations varied in nutritive value.

Further, independent samples t-test was carried out on private versus public restaurants, private versus fast food restaurants and public versus fast food restaurants to test the significance of difference between these restaurants. The results of t-test have been presented in Tables 3 to Table 5. It may be noted that the degree of freedom being 4, the tabulated value of t is 2.132 and 3.747 at 0.05 and 0.01 probability levels respectively. The calculated values of t for the comparisons are highly significant at both the probability levels in majority

of the cases. This further authenticates that the private, public and fast food restaurants differ significantly from each other in nutritive value of the selected recipes. The results of the evaluation of the nutritional quality are presented as under:

a) Proximate Composition Analysis of Karahi Paneer Samples

Proximate composition analysis for energy, carbohydrate, protein, fats and fibre content was done using Socplus, Kelplus and Fibraplus series. The values were calculated in triplicate and thereafter the mean values were calculated for usage in further discussions. There is a wide range of listings in the menus of the different types of studied restaurants and there is an increased trend of consumption of snacks especially by the adolescents at fast food restaurants. In order to maintain the uniformity for comparative analysis for all the three types of restaurants, the focus was to select the same recipes from all the studied restaurants. This recipe was selected in consultation with restaurant managers of different restaurants as well as from the respondents as this was most commonly ordered by the guests while dining out in all the three types of restaurants. The standardized recipe was also developed in consultation with the chefs of different restaurants and thereafter prepared by the researcher in laboratory under hygienic settings. The details of the ingredients and method of preparation of the standardized recipe has been discussed in Annexure 1.

b) Evaluation of Nutritional Quality of Karahi Paneer

Proximate composition analysis were performed on the samples of karahi paneer procured from private, public and fast food restaurants to evaluate their energy, carbohydrate, protein, fats and fibre content. They were then compared amongst each other and with the standardized recipe for any variation in their nutritive value.

The mean scores for energy are 366.9 ± 14.30 kcal, 335.0 ± 11.03 kcal and 359.4 ± 27.08 kcal for karahi paneer served in the studied private, public and fast food restaurants. In comparison to standardized recipe with a mean energy value of 450.9 ± 0.00 kcal, lesser calorie content has been shown among karahi paneer served at all three types of restaurants perhaps due to over cooking and repeated heating. The comparison of carbohydrate content has been found to be the highest in private restaurants with a mean value of 15.50 ± 0.10 g while the same has been the lowest among fast food restaurants with a mean value of 7.76 ± 0.05 g. A decline has been witnessed in protein content of karahi paneer served at selected restaurants as compared to the standardized recipe with mean scores of 7.82 ± 0.52 g, 7.21 ± 0.15 g and 8.14 ± 0.20 g for private, public and fast food restaurants

respectively. An increase has been observed in fat content of karahi paneer being served at all three types of restaurants with mean scores of 30.40 ± 1.85 g, 29.97 ± 1.16 g and 32.87 ± 3.07 g respectively for private, public and fast food restaurants while fat present in the standardized recipe has a mean value of 28.91 ± 0.00 g only. The reason behind this may be the amount of ghee or oil used in sauteing. The values of mean fibre content present in karahi paneer are 0.72 ± 0.05 g, 0.90 ± 0.09 g and 0.94 ± 0.06 g respectively for R1, R2 and R3. However, mean scores for fibre in the standardized recipe is 0.89 ± 0.00 g. Interestingly, a slight increment in amount of fibre of a few selected organizations may be due to raw garnishing (capsicum and onion rings) used for presentation. Table 1 depicts the mean and standard deviation of karahi paneer samples.

Table 1: Comparison of Proximate Values of Karahi Paneer (KP) served at Private, Public and Fast Food Restaurants

KP	Energy (kcal)		Carbohydrate (g)		Protein (g)		Fats (g)		Fibre (g)	
	Mean	S.D.*	Mean	S.D.*	Mean	S.D.*	Mean	S.D.*	Mean	S.D.*
R1	366.9	14.30	15.50	0.10	7.82	0.52	30.40	1.85	0.72	0.05
R2	335.0	11.03	9.13	0.01	7.21	0.15	29.97	1.16	0.90	0.09
R3	359.4	27.08	7.76	0.05	8.14	0.20	32.87	3.07	0.94	0.06
SR**	450.9	0.00	9.88	0.00	9.20	0.00	28.91	0.00	0.89	0.00

* Standard Deviation

** Standardised Recipe

Energy

While appraising results of energy means from Table 1 of karahi paneer served at various restaurants, it was noted that private restaurants (R1) have the highest mean value of 366.9 ± 14.30 kcal and public restaurants (R2) have the lowest mean value of 335.0 ± 11.03 kcal for energy and none of them has been able to meet the energy levels of the standardised recipe value. The calculated F-value of 2.354 (Table 2) is lesser than the tabulated value which sustained that the energy supplied by all three types of restaurants is significantly indifferent. Results of t-test were inspected to confirm this. The results marked a significant difference between private versus public restaurants with a p-value of 0.038 at 95 per cent confidence level (Table 3) whereas the difference observed was insignificant with a p-value of 0.694 and 0.223 respectively at the same level of confidence between private versus fast food (Table 4) and public versus fast food restaurants owing to lower t-values (Table 5) as compared to the tabulated ones.

This is in accordance with ANOVA conclusions as well.

Carbohydrate

Means of carbohydrate component from Table 1 of the studied restaurants showed that private restaurants (R1) have the highest mean value of 15.50 ± 0.10 g and fast food restaurants (R3) have the lowest mean value of 7.76 ± 0.05 g for carbohydrates and the mean values of public and fast food restaurants are comparatively closer to the standardised recipe value. The calculated F-value of 11902.488 (Table 2) is significantly higher than the tabulated value which proves the clear cut difference in karahi paneer of the selected restaurants. To further confirm this, results of t-test were inspected, which hold up that the calculated values of t were much higher than the respective tabulated values (Tables 3 to 5) thereby authenticating the results of high significance of ANOVA.

Table 2: Analysis of Variance (ANOVA) among Nutritive Value of Karahi Paneer served at Private, Public and Fast Food Restaurants

		Sum of Squares	df	Mean Square	F	Sig.
Energy	Between Groups	1662.396	2	831.198	2.354	.176
	Within Groups	2118.568	6	353.095		
	Total	3780.965	8			
Carbohydrate	Between Groups	102.361	2	51.181	11902.488	.000**
	Within Groups	.026	6	.004		
	Total	102.387	8			
Protein	Between Groups	1.350	2	.675	6.170	.035*
	Within Groups	.656	6	.109		
	Total	2.006	8			
Fats	Between Groups	14.682	2	7.341	1.553	.286
	Within Groups	28.353	6	4.726		
	Total	43.036	8			
Fibre	Between Groups	.081	2	.040	8.215	.019*
	Within Groups	.029	6	.005		
	Total	.110	8			

*Significant at $p \leq 0.05$

** Significant at $p \leq 0.001$

Protein

Protein means from Table 1 of the selected units revealed that fast food restaurants (R3) have maximum mean value of 8.14 ± 0.20 g and public restaurants (R2) have minimum mean value of 7.21 ± 0.15 g for protein and none of them has been able to achieve the standardised recipe value thereby proving the protein deficit reality of restaurant food. The calculated F-value of 6.170 (Table 2) is higher than the tabulated value which holds that karahi paneer served at all of them is

significantly different.

Outcomes of t- tests were checked to validate. The results sustained that public and fast food restaurants were different in protein content due to significant p-value of 0.003 at 95 per cent confidence level (Table 5) whereas private versus public restaurants (Table 3) and private versus fast food restaurants (Table 4) were at par in terms of protein value of karahi paneer due to lower t values as compared to the respective tabulated ones. Hence, ANOVA results are endorsed.

Table 3: Comparison of Nutritive Value of Karahi Paneer served at Private and Public Restaurants.

		t	df	Sig. (2-tailed)
Energy	Equal variances assumed	3.054	4	.038*
	Equal variances not assumed	3.054	3.758	.041*
Carbohydrate	Equal variances assumed	109.784	4	.000**
	Equal variances not assumed	109.784	2.040	.000**
Protein	Equal variances assumed	1.967	4	.121
	Equal variances not assumed	1.967	2.332	.170
Fats	Equal variances assumed	.344	4	.748
	Equal variances not assumed	.344	3.358	.752
Fibre	Equal variances assumed	-2.959	4	.042*
	Equal variances not assumed	-2.959	3.165	.056

*Significant at $p \leq 0.05$

** Significant at $p \leq 0.001$

Table 4: Comparison of Nutritive Value of Karahi Paneer served at Private and Fast Food Restaurants

		t	df	Sig. (2-tailed)
Energy	Equal variances assumed	.423	4	.694
	Equal variances not assumed	.423	3.034	.700
Carbohydrate	Equal variances assumed	118.494	4	.000**
	Equal variances not assumed	118.494	3.039	.000**
Protein	Equal variances assumed	-1.003	4	.373
	Equal variances not assumed	-1.003	2.531	.402
Fats	Equal variances assumed	-1.193	4	.299
	Equal variances not assumed	-1.193	3.288	.312
Fibre	Equal variances assumed	-4.716	4	.009*
	Equal variances not assumed	-4.716	3.915	.010*

*Significant at $p \leq 0.05$

** Significant at $p \leq 0.001$

Fats

An assessment of fats means from Table 1 of the selected units unveiled that fast food restaurants (R3) have the highest mean value of 32.87 ± 3.07 g and public restaurants (R2) have the lowest mean values of 29.97 ± 1.16 g for fats and all of them provide more fats as compared to the standardised recipe value. The calculated F-value of 1.553 (Table 2) is less than the tabulated value which meant that the amount of fat present in karahi paneer of the selected units is similar among

various organizations.

To further prove this, results of t-test I to III were examined. The outcomes established that calculated values of t (Table 3 to 5) were also lower than the respective tabulated values. The corresponding p-values for all three comparisons were found to be more than 0.05 at 95 per cent confidence level thus highlighting the insignificant difference among all three types of private, public and fast food studied restaurants and favouring ANOVA conclusions.

Table 5: Comparison of Nutritive Value of Karahi Paneer served at Public and Fast Food Restaurants.

		t	df	Sig. (2-tailed)
Energy	Equal variances assumed	-1.443	4	.223
	Equal variances not assumed	-1.443	2.645	.256
Carbohydrate	Equal variances assumed	44.064	4	.000**
	Equal variances not assumed	44.064	2.143	.000**
Protein	Equal variances assumed	-6.659	4	.003*
	Equal variances not assumed	-6.659	3.790	.003*
Fats	Equal variances assumed	-1.532	4	.200
	Equal variances not assumed	-1.532	2.560	.238
Fibre	Equal variances assumed	-.579	4	.594
	Equal variances not assumed	-.579	3.457	.598

*Significant at $p \leq 0.05$

** Significant at $p \leq 0.001$

Fibre

Means of fibre component from Table 1 of the studied restaurants exposed that fast food restaurants (R3) have the highest mean value of 0.94 ± 0.06 g and private restaurants (R1) have the lowest mean value of 0.72 ± 0.05 g for fibre and the difference between all three types of restaurants was small. The calculated F-value of 8.215 (Table 2) is a bit higher than the tabulated value which proved that fibre present in karahi paneer of the units is having significant difference in the amount of fibre.

To further establish this, results of t-test were evaluated which marked that the calculated values of t were lower than the

respective tabulated values (Tables 3 to 5). The p-value for t-test between private versus public restaurants is 0.042 and between private and fast food restaurants is 0.009 at 95 per cent confidence level which states that there exists a significant difference between them. However, the results of t-test applied on public versus fast food restaurants highlights the insignificant relationship between these types with a p-value of 0.594 at the same level of confidence thus proving the ANOVA results.

B. Checking Nutritional Adequacy of Karahi Paneer

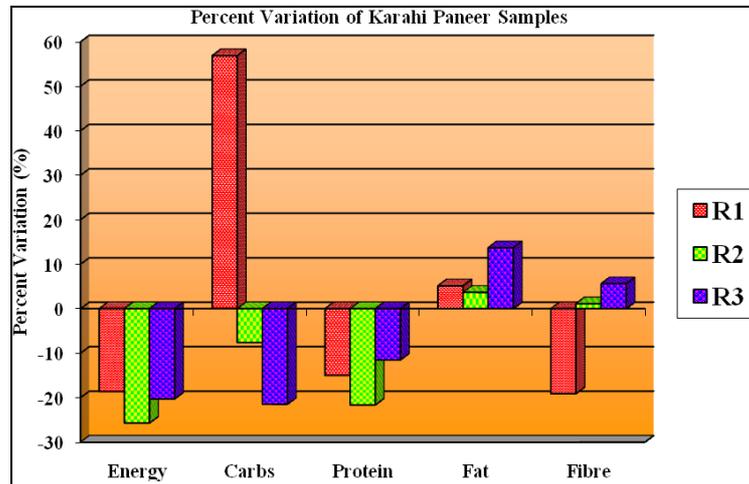


Fig 2: Percent Variation in Nutritional Adequacy of Karahi Paneer served at Private, Public and Fast Food Restaurants

Figure 2 demonstrates the percent variation in the nutritive value of karahi paneer served at private, public and fast food restaurants amongst each other and with the standardized recipe values. The bar graph exhibited that karahi paneer served at most of the studied restaurants was found to be deficient in calories and proteins with reference to the standardized recipe. The karahi paneer of private restaurants (R1) was higher in carbohydrate (56 per cent) and fat (5 per cent) content whereas that served in public (R2) as well as fast food restaurants (R3) ranked higher in fat (4 per cent and 13 per cent respectively) and fibre (1 per cent and 6 per cent respectively) content only. However, a high downfall in fibre content (20 per cent) has been observed in case of private restaurants.

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